

Serial No.: 10/030,134



Docket No. 020085

IN THE UNITED STATES PATENT & TRADEMAR OFFICE

Applicant: TAZAKI, Satoshi : Group Art Unit: 1774
Serial No.: 10/030,134 : Examiner: Tamra L. Dicus
Filed: January 25, 2002 :
For: MOLDING HAVING INK LAYER

BOX AMENDMENT

Assistant Commissioner for Patents

Washington, D.C. 20231

DECLARATION UNDER 37 CFR 1.132

Dear Sir:

Teiji KOHARA declares that:

1. He is an engineer employed by the assignee company, ZEON CORPORATION, and has been engaged in various aspects of research work with respect to the research and development of alicyclic structure-containing polymers.

2. He is familiar with the present application Serial No. 10/030,134

filed January 25, 2002, is familiar with the Office Action dated September 24, 2004 and the references cited therein.

3. In response to the Comments set forth by the Examiner in the Office Action, the following experiments were carried out in order to demonstrate that the combination of Shinohara's polymer with Von Trebra's pigment/carrier will not necessarily meet the limitations of present claims 1 and 3.

More specifically, the experiments demonstrates that the fact that in a molding formed from an alicyclic structure-containing polymer described in the Shinohara et al. U.S. Patent No. 5,516,456, on the surface of which a pattern has been formed by an ink described in the Von Trebra et al. U.S. Patent No. 5,360,688, the retention of an ink layer containing the pattern when a 1-cm² portion arbitrarily selected from the surface of the molding is subjected to a tape peeling adhesion test is at least 80% is neither obvious nor inherent.

The fact that the invention of the present application exhibits a marked effect is also demonstrated by determining interfacial separation in a long-time high-temperature and high-humidity test and changes in optical properties caused thereby as to moldings whose retention of the ink layer is lower than 80%.

These experiments further demonstrate that the fact that the index of wetting of the ink layer containing the ink described in the Von Trebra et al. U.S. Patent No. 5,360,688 on the molding formed from the alicyclic structure-containing polymer described in the Shinohara et al. U.S. Patent No. 5,516,456 is at most 42 dyn/cm is neither obvious nor inherent.

4. The following experiments were carried out either by Mr.

KOHARA or otherwise carried out under his direct control and supervision:

Experiment 1

Preparation of polymer described in the Shinohara et al. U.S. Patent No.

5,516,456

A reaction vessel containing 750 kg of toluene was charged with 250 kg of 8-methyl-8-carboxymethyltetracyclo-[4.4.0.1^{2,5}.1^{7,10}.]-3-dodecene and 18 kg of 1-hexene as a molecular weight modifier, and the contents were heated to 60°C. To the mixture were added 0.62 kg of a toluene solution of triethylaluminum (1.5 mol/l) that is a polymerization catalyst and 3.7 kg of a WCl₆ solution (concentration: 0.05 mol/l) prepared by denaturing WCl₆ with tert-butanol and methanol and having a molar ratio of tert-butanol:methanol:tungsten of 0.35:0.3:1.

The resultant mixture was heated and stirred at 80°C for 3 hours to obtain a polymer solution A. The polymerization conversion rate in this polymerization reaction was 97%, and the inherent viscosity (η_{inh}) was 0.64. An autoclave was charged with 1,000 kg of the resultant polymer solution A, to which 0.12 kg of RuHCl(CO)[P(C₆H₅)₃]₃ was added to conduct a hydrogenation reaction by heating and stirring under conditions of a hydrogen gas pressure of 100 kg/cm² and a reaction temperature of 165°C.

After the resultant reaction mixture was passed through a guard filter, the solvent, monomer and other volatile components were removed by a direct drying method using a centrifugal thin-film continuous evaporator dryer. The resultant molten resin was pelletized by a melt extruder to obtain an alicyclic structure-containing polymer.

The hydrogenation rate of the alicyclic structure-containing polymer obtained in the above-described manner was substantially 100%, and the glass transition temperature thereof was 169°C.

Experiment 2

Production of light guide plate

100 parts by weight of the alicyclic structure-containing polymer obtained in Experiment 1 were mixed with 0.5 parts by weight of a phenolic antioxidant, pentaerythrityl-tetrakis(3-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate), and the resultant mixture was kneaded by a twin-screw kneader, and the resultant strand (rod-like molten resin) was passed through a strand cutter to obtain a pellet-like (particulate) molding material. The pellets were injection-molded into a light guide plate. The molding conditions were as follows.

An injection molding machine (Product No. IS450, manufactured by Toshiba Machine Co., Ltd.) was used, a mold temperature was 120°C, a cylinder temperature was 320°C, a nozzle temperature was 310°C, an injection pressure was 1,000 kgf/cm², a dwell pressure was 800 kgf/cm², a clamping pressure was 1,200 kgf/cm², an injection speed (corresponding to an advanced speed of the screw) was 40 mm/sec, a back pressure on the screw was 70 kgf/cm², and a screw speed was 30 rpm. The time from the beginning of injection into a mold to completion of the injection was 1 second.

The light guide plate thus obtained was in the form of a wedge that a thickness of a thick-wall portion on the side of the plane of incidence is 2.5 mm, a thickness of a thin-wall portion on the opposite side is 1.5 mm, a length from the side of the thick-wall portion to the side of the thin-wall portion (length in

the longitudinal direction of the light guide plate from a light source) is 190 mm, a length along the axial direction of the linear light source is 280 mm, and the thickness gradually thins as it becomes more distant from the side of the thick-wall portion to the side of the thin-wall portion (in a direction substantially perpendicular to the axis of the linear light source).

Neither occurrence of short shot nor occurrence of flash was observed upon release from the mold, and no cracking of the molding was also observed.

Experiment 3

Preparation of ink containing cellulose acetate as a carrier

An ink medium (colorless ink) (1) was prepared by mixing 100 parts by weight of a 10% ethyl acetate solution of cellulose acetate (LT-35, product of Dical Chemical Industries Co., Ltd.) with 1 part by weight of micronized silica (Sylysia 445, product of Fuji Silysia Chemical, Ltd.) as a viscosity modifier.

An ink A was further prepared by mixing 100 parts by weight of this ink medium (1) with 2 parts by weight of Rutile-type titanium dioxide (SR-1, product of Sakai Chemical Industry Co., Ltd.) as a white pigment.

An ink B was also prepared by mixing 100 parts by weight of the ink medium (1) with 0.5 parts by weight of carbon black (MA100, product of Mitsubishi Chemical Corporation) as a black pigment.

Experiment 4

Preparation of ink containing acrylic polymer as a carrier

An ink medium (colorless ink) (2) was prepared by mixing 100 parts by weight of a 50% ethyl acetate solution of dipentaerythritol hexaacrylate (NK

Ester A-DPH, product of Shin-Nakamura Chemical Co., Ltd.) with 1.5 parts by weight of IRGACURE 907, product of Ciba Specialty Chemicals) as a photo-cure initiator and 2 parts by weight of micronized silica (Sylysia 445, product of Fuji Silysia Chemical, Ltd.) as a viscosity modifier.

An ink C was further prepared by mixing 100 parts by weight of this ink medium (2) with 2 parts by weight of rutile-type titanium dioxide (SR-1, product of Sakai Chemical Industry Co., Ltd.) as a white pigment.

An ink D was also prepared by mixing 100 parts by weight of the ink medium (2) with 0.5 parts by weight of carbon black (MA100, product of Mitsubishi Chemical Corporation) as a black pigment.

Experiment 5

Measurement of index of wetting

The whole surface of one side of the light guide plate obtained in Experiment 2 was printed with each of the inks A to D obtained in Experiments 3 and 4. In the case of the solvent-dry type inks A and B, the printed light guide plates were left to stand for 2 hours at room temperature to dry them. In the case of the photo-cure type inks C and D, the printed light guide plates were exposed to ultraviolet light in a cumulative quantity of light of 450 mJ/cm² and then left to stand for 2 hours at room temperature to remove the solvent.

The indexes of wetting of the respective ink layers thus obtained were measured in accordance with JIS K 6768. As a result, the indexes of wetting were 46 dyn/cm for the inks A and B and 43 dyn/cm for the inks C and D.

Experiment 6

Determination of retention of patterned ink layer

A corona discharge treatment was conducted on one surface of the light guide plate obtained in Experiment 2. The inks obtained in Experiments 3 and 4 were separately used to print a pattern composed of a plurality of white circular dots that the diameter of each dot gradually increases from the side of the thick-wall portion to the side of the thin-wall portion on the treated surface of the light guide plate by screen printing (size of the circular dot: 0.4 to 0.7 mm in diameter; interval between the central points of the dots: 0.8 mm). The drying and curing of the inks were conducted in the same manner as in Experiment 5.

The same pressure sensitive adhesive tape as that used in the cross-cut adhesion test prescribed in JIS K 5400 was struck on an arbitrary 1-cm² square area of the light guide plate having the ink layer, and the pressure sensitive adhesive tape was peeled in the same manner as in the cross-cut adhesion test to find a retention of the pattern [(number of remaining dots/total number of dots in the area) x 100 [%]].

As a result, the retentions of the pattern were 0% for the inks A and B, 75% for the ink C and 77% for the ink D.

Experiment 7

Change in optical properties in long-time high-temperature and high-humidity test

A corona discharge treatment was conducted on one surface of the light guide plate obtained in Experiment 2. The inks containing the white pigment

among the inks obtained in Experiments 3 and 4 were separately used to conduct the same printing as in Experiment 6.

The reason why only the inks containing the white pigment among the inks prepared were tested in this experiment is that the measurement of luminance and luminance mottling cannot be conducted on the inks containing the black pigment.

The light guide plates having the ink layer were separately used to fabricate a back light unit in accordance with a process described below to measure an average luminance and luminance mottling at an initial stage and after a high-temperature and high-humidity test (left to stand for 500 hours at a temperature of 60°C and a relative humidity of 90%).

The back light unit was fabricated by using RF195E (product of TSUJIDEN CO., LTD.) as a reflecting sheet on a reflecting surface (printed surface) side of the light guide plate and D122J (product of TSUJIDEN CO., LTD.) as a light-diffusing sheet on an outgoing surface of light thereof. Upon the measurement of the luminance and luminance mottling, the light emitting area was divided into 9 portions (divided into 3 portions in horizontal and vertical directions) after assembling the back light unit and left to stand for 30 minutes after lighting a lamp.

The luminance was measured at a position vertically upward 60 cm away from the central point of each divided portion by means of a colorimetric luminance meter (BM-7, manufactured by Topukon K.K). An average of values at the 9 positions was regarded as the average luminance, and a deviation (%) of the maximum luminance to the average luminance was regarded as the luminance mottling.

The results are shown collectively together with the results of Experiments 5 and 6 in the following Table 1.

Table 1

Ink	Pigment	Base resin	Index of wetting (dyn/cm)	Retention (%)	luminance (cd/m ²)		Luminance mottling (%)	
					Before test	After test	Before test	After test
A	Rutile-type titanium dioxide	Cellulose acetate	46	0	750	Immeasurable	40	Immeasurable
B	Carbon black		46	0	-	-	-	-
C	Rutile-type titanium dioxide	Acrylic polymer (Dipentaerythritol hexaacrylate)	43	75	1090	880	15	35
D	Carbon black		43	77	-	-	-	-

Consideration

The following is known from Experiment 6.

The fact that in a molding formed from the alicyclic structure-containing polymer described in the Shinohara et al. U.S. Patent No. 5,516,456 and containing a pattern formed by the ink described in the Von Trebra et al. U.S. Patent No. 5,360,688, the retention of the ink layer containing the pattern when a 1-cm² portion arbitrarily selected from the surface of the molding is subjected to a tape peeling adhesion test is at least 80% is neither obvious nor inherent.

The following is known from Experiment 7.

The molding formed from the alicyclic structure-containing polymer, on the surface of which a pattern has been formed by the ink, and wherein the retention of the ink layer containing the pattern when a 1-cm² portion arbitrarily selected from the surface of the molding is subjected to the tape peeling adhesion test is lower than 80% is markedly lowered in optical properties in the long-time high-temperature and high-humidity test (percent reduction of luminance in the ink A: 100%; and percent reduction of luminance in the ink C: 20%).

On the contrary, the molding formed from the alicyclic structure-containing polymer, on the surface of which a pattern has been formed by the ink, and wherein the retention of the ink layer containing the pattern when a 1-cm² portion arbitrarily selected from the surface of the molding is subjected to the tape peeling adhesion test is at least 80% exhibits a marked effect that its optical properties are scarcely changed in the long-time high-temperature and high-humidity test (in Examples 1 to 4 of the present application, percent reduction of luminance in Example 1: 2.8%; percent reduction of luminance in Example 2: 2.9%; percent reduction of luminance in Example 3: 13.5%; and percent reduction of luminance in Example 4: 14.8%).

The following is known from Experiment 5.

The fact that the index of wetting of the ink layer containing the ink described in the Von Trebra et al. U.S. Patent No. 5,360,688 on the molding formed from the alicyclic structure-containing polymer described in the Shinohara et al. U.S. Patent No. 5,516,456 is at most 42 dyn/cm is neither obvious nor inherent.

5. Teiji KOHARA declares that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Respectfully submitted,

Teiji Kohara

Teiji KOHARA

Mar. 14, 2005

Date